

Wither U.S. Net Neutrality Regulation?

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Abstract I examine the (lack of) economic logic that underlies the U.S. Federal Communications Commission’s latest iteration of network neutrality regulations. I explore potential unintended consequences and find a substantial tension between the regulations and the objective of promoting consumer choice and sovereignty. I also identify market developments that could largely neutralize the regulations unless they are expanded to constrain Internet access providers’ actions further.

Keywords Regulation · Net neutrality · Internet service providers · Edge providers

1 Introduction

In February 2015, the Federal Communications Commission (Commission) imposed its most recent round of regulations that govern the behavior of firms that provide broadband Internet access services (BIAS).¹ Figure 1 illustrates how the Commission conceptualizes BIAS provision. A BIAS provider is a platform that connects *edge providers* and *end users*. According to the Commission, end user “refers to any individual or entity that uses a broadband Internet access service,” and edge provider “refer[s] to content, application, service, and device providers, because they generally operate at the edge rather than the core of the network. These terms are not mutually exclusive.”²

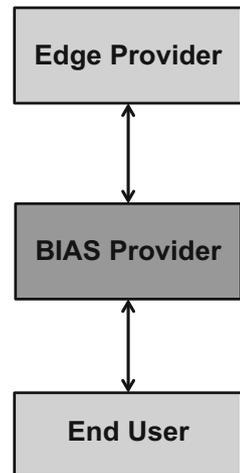
¹ Federal Communications Commission (2015). The firms that the Commission refers to as BIAS providers are more commonly known as Internet Service Providers, or ISPs.

² Federal Communications Commission (2010, footnote 2).

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Fig. 1 A BIAS platform connects edge providers and end users



A BIAS provider uses its “last mile” facilities to connect end users to its routers and, through them, to the rest of the Internet. Although not illustrated in Fig. 1, an edge provider can reach the BIAS provider’s platform either through direct connection to the BIAS provider’s network facilities or through an intermediary network.

The Commission’s regulations generally constrain a BIAS provider’s treatment of edge providers. In particular, any BIAS provider must comply with the following conditions³:

- **No Blocking:** “A person engaged in the provision of broadband Internet access service, insofar as such person is so engaged, shall not block lawful content, applications, services, or non-harmful devices, subject to reasonable network management.”⁴
- **No Throttling:** “A person engaged in the provision of broadband Internet access service, insofar as such person is so engaged, shall not impair or degrade lawful Internet traffic on the basis of Internet content, application, or service, or use of a non-harmful device, subject to reasonable network management.”⁵
- **No Access Charges Levied on Edge Providers:** The “no-blocking rule prohibits broadband providers from charging edge providers a fee to avoid having the edge providers’ content, service, or application blocked from reaching the broadband provider’s end-user customer.”⁶ Similar language is applied to fees to avoid throttling.⁷

³ Federal Communications Commission (2015, ¶¶ 4 and 23–24) also reaffirmed and “enhanced” the transparency requirements of Federal Communications Commission (2010). Consideration of the transparency rule is outside of the scope of the present analysis.

⁴ Federal Communications Commission (2015, ¶¶ 15 and 112), emphasis in original.

⁵ *Id.*, ¶ 16, emphasis in original.

⁶ *Id.*, ¶ 113, footnote omitted.

⁷ *Id.*, ¶ 120.

- **No Paid Prioritization:** “A person engaged in the provision of broadband Internet access service, insofar as such person is so engaged, shall not engage in paid prioritization.”⁸ Paid prioritization is defined as “the management of a broadband provider’s network to directly or indirectly favor some traffic over other traffic, including through use of techniques such as traffic shaping, prioritization, resource reservation, or other forms of preferential traffic management, either (a) in exchange for consideration (monetary or otherwise) from a third party, or (b) to benefit an affiliated entity.”⁹ There is no exception to this provision for “reasonable network management.”¹⁰
- **No-Unreasonable Interference/Disadvantage Standard:** In addition to these specific rules, the order includes a catch-all rule¹¹:

Any person engaged in the provision of broadband Internet access service, insofar as such person is so engaged, shall not unreasonably interfere with or unreasonably disadvantage (i) end users’ ability to select, access, and use broadband Internet access service or the lawful Internet content, applications, services, or devices of their choice, or (ii) edge providers’ ability to make lawful content, applications, services, or devices available to end users. Reasonable network management shall not be considered a violation of this rule.

These regulations are ostensibly intended protect and promote “openness” because—according to the Commission—“the Internet’s openness promotes innovation, investment, competition, free expression, and other national broadband goals.”¹² The Commission has also identified more-specific rationales, including promoting free speech and civic engagement by preventing BIAS providers from censoring edge providers,¹³ and preventing exclusionary behavior whereby vertically integrated access providers “favor[] their own or affiliated content over other[,] third-party sources.”¹⁴

In this article, I explore some of what economics says about the relationship between the Commission’s stated objectives and the possible or likely effects of its current rules. I focus on the rationales for—and effects of—the ban on access charges that are levied on edge providers and the prohibition of paid prioritization. As will become evident, I conclude that the Commission has made several claims about the benefits of its policies that economics does not support. I also conclude that the open Internet regulations are likely to have several adverse and/or

⁸ *Id.*, ¶ 18, emphasis in original.

⁹ *Id.*, emphasis in original.

¹⁰ *Id.*, footnote 18.

¹¹ *Id.*, ¶ 21, emphasis in original.

¹² *Id.*, ¶ 76. I note that the Commission’s fundamental premise with regard to the benefits of openness (as defined by the Commission) has no firm grounding in facts or theory. It is possible, or even likely, that the Internet could have been an even greater success with a different architecture (e.g., one that more readily allowed for quality-of-service commitments).

¹³ *Id.*, ¶ 77.

¹⁴ *Id.*, ¶ 82.

unintended consequences, including the stimulation of market trends that may undermine the regulations themselves.

This article proceeds as follows: In Sect. 2, I examine several rationales that the Commission has put forth to justify its ban on BIAS providers' charging edge providers for access to end users. I argue that the Commission's various rationales (e.g., promoting free speech and creativity) generally lack limiting principles and do not justify the pricing ban. And I show that, although the Commission claims to be seeking to prevent exclusionary behavior, its rules may actually *increase* the incentive for a vertically integrated BIAS provider to engage in foreclosure against competing edge providers. In Sect. 3, I consider the Commission's prohibition of paid prioritization, and I show that there is a substantial risk that it will be a Robinson–Patman Act for the twenty-first century (i.e., a policy that seeks to limit competition under the guise of preventing anticompetitive price discrimination).¹⁵

In Sect. 4, I argue that gaps in the current regulations—coupled with certain market developments (some of which will be hastened by the regulations themselves)—will render the rules increasingly ineffectual. Perhaps the most fundamental implication of this finding is that it reveals a substantial conflict between the Commission's regulations and its stated objective of promoting consumer sovereignty and choice. In a brief concluding section, I argue that the current state of the regulations is unstable, and that proponents are likely to call for even more extensive and stringent regulations.

2 The Commission's Rationales for Price Regulation

As discussed in the Introduction, the Commission's rules ban BIAS providers from charging edge providers fees for terminating access services.¹⁶ To some extent, the pricing restriction can be seen as a necessary adjunct to the rules that prohibit blocking and throttling: Absent any constraint, a BIAS provider could replicate the effects of outright blocking and throttling by imposing appropriately designed price schedules. However, the Commission's ban on access pricing goes much farther.

In this section, I consider five additional rationales that the Commission has stated for its policies, and I analyze whether they support the ban on access pricing. I find that they do not.

2.1 Literally Free Speech

The Commission has expressed concern that, left unchecked, BIAS providers could engage in censorship.¹⁷ I suspect that the vast majority of BIAS providers do not

¹⁵ For a discussion of some of the ways in which the Robinson–Patman Act harmed competition, see Schwartz (1986).

¹⁶ I refer to access fees that are charged by a BIAS provider to edge providers as “terminating” access fees based on the fact that an end user's choice determines which BIAS provider an edge provider must use to reach that end user. The terminology should not be taken to imply that end users cannot initiate or originate data exchanges.

¹⁷ See, e.g., Federal Communications Commission (2015, ¶¶ 77 and 143).

want to regulate non-commercial speech, which raises serious doubts about whether the rules are necessary.¹⁸ But even if free-speech concerns are valid, at best they justify only the no-blocking and no-throttling rules.¹⁹

Any linkage to a rule that bans BIAS providers from levying *any* charges on edge providers for connecting to end users is more tenuous and suffers from the lack of a limiting principle. For example, if the Commission believes it necessary to force BIAS providers to let edge providers speak for free, then why wouldn't the same arguments apply to end users as well? Indeed, the Commission's distinction between edge provider and end user is largely meaningless, as much of the content on the Internet is created by end users.²⁰ The Commission previously stated that²¹:

We propose not to adopt a specific definition of “content, application, or service provider,” because any user of the Internet can be such a provider. For example, anyone who creates a family website for sharing photographs could be reasonably classified as a “content provider.”

By the Commission's definition, an entity could simultaneously be an edge provider and end user.²² Hence, if we apply the Commission's logic, BIAS providers should not be allowed to charge anyone—whether an edge provider or an end user. Although no doubt some proponents of net neutrality believe that Internet access should be free for edge providers and end users alike, it should be evident that mandating free Internet access for all would dramatically attenuate BIAS providers' investment incentives and undermine their commercial viability, at least under current business models.

The Commission's free-speech rationale would be unconvincing even if the Commission could create a definition that cleanly distinguished edge providers from end users. By applying the rules only to the prices that are charged to edge providers, the Commission must implicitly be putting more weight on the speech of edge providers than on that of end users. In fact, the imbalance is worse than it first appears because the ban on charging edge providers very likely increases the prices that are charged to end users for reasons that are discussed in detail below. It is difficult, if not impossible, to think of a good reason for public policy to favor the speech of edge providers over that of end users.

The lack of a valid limiting principle is further highlighted by considering other media. The argument that an important vehicle for speech should be literally free would apply equally well to situations in which anyone wanted to speak through a

¹⁸ This is quite likely one of the reasons that the no-blocking rule tends to be one of the least contentious regulations.

¹⁹ This statement should not be read as an endorsement of these rules. There also are important legal issues that surround them that I am not addressing.

²⁰ See, e.g., Lee and Wu (2009, p. 66) citing Lessig and McChesney (2006). The lack of clear distinction between edge providers and end users may reflect the fact that the distinction that the Commission actually intended to draw is based on whether the party in question is the one that chooses the BIAS provider. I will address this issue below in my discussion of the terminating access monopoly problem.

²¹ Federal Communications Commission (2009, ¶ 99).

²² Recall the quotation of the Federal Communications Commission (2010, footnote 2) in the Introduction to this article that stated that the terms are not mutually exclusive.

newspaper, magazine, or radio or television broadcast. Although all of those media have limited capacities, so do many BIAS networks—especially mobile wireless ones. The difference is one of degree. Further, I am unaware of any justification for forcing BIAS providers and media owners to subsidize the speech of others, as opposed to raising subsidy funds from citizens at large through taxation.²³

In summary, free-speech concerns provide a poor justification for limiting BIAS providers' ability to charge edge providers for access services.

2.2 “Permissionless” Innovation

At least part of the Commission's rationale for preventing BIAS providers from charging edge providers for terminating access services is the claim that such charges would make it impossible for edge providers to innovate without obtaining permission from BIAS providers.²⁴ Using the term “permission” in this way, however, is misleading in that there are two separable issues: (1) obtaining individualized authorization to exchange traffic with end users; and (2) paying to exchange traffic with end users. Being able to obtain access services only if one pays according to a publicly posted fee schedule of general applicability is not the same as having to obtain permission.²⁵ Policymakers do not worry, for example, that innovation is hampered because potential innovators have to seek the “permission” of electric power companies (i.e., pay for electricity) even though few, if any, innovators could prosper without access to electricity; this is a point that the Commission itself has recognized but then ignored.²⁶

2.3 Subsidizing Creativity

Lee and Wu (2009) propose “subsidizing creativity” as a rationale for banning access fees.²⁷ In doing so, Lee and Wu (implicitly) argue that: (a) raising subsidy revenues through a specific tax on end-user consumers of BIAS is better than raising subsidy revenues through the overall system of income taxation or a broad sales tax, counter to the general principles that broad tax bases are more efficient than narrow ones and that tax policies should be coordinated to minimize the welfare costs conditional on the amount of revenue raised; (b) it is better to grant funds blindly than to use either a market test or public policy evaluation; and (c) it is better to subsidize creativity in kind rather than with cash, even though the latter generally is

²³ The only exception might be radio and television broadcasters, who were given valuable spectrum rights for free in return for accepting certain obligations.

²⁴ See, e.g., Federal Communications Commission (2015, ¶ 86, 2010, ¶¶ 3, 10, and 93).

²⁵ Use of the term permission would make more sense if prices were particularized to specific edge providers *and*, in some cases, intentionally set to discourage those edge providers from reaching end users.

²⁶ Federal Communications Commission (2010, ¶ 13).

²⁷ As far as I am aware, the Commission has not adopted an explicit rationale of subsidizing creativity. However, it has asserted that BIAS providers “can extract unfair tolls” that would harm innovation (Federal Communications Commission 2015, ¶ 20; see, also, ¶ 82).

more efficient. Clearly these arguments for subsidizing creativity in this way are highly suspect.

Moreover, as long as BIAS providers do not levy usage-sensitive charges on end users, the in-kind subsidy in the form of free terminating access is particularly valuable to applications that make wasteful use of bandwidth.²⁸ This does not seem to be a desirable policy outcome.

Lee and Wu (2009) provide no analysis of why creativity should be subsidized through this one resource or why it would not be preferable to subsidize a low-income household's receiving healthcare services rather than subsidize an online shoe store's providing 4K, 3D images of its footwear.

The argument for banning edge provider access charges also ignores the policy's harm to end users. Absent a prohibition by the Commission, two-sided pricing could play an important role in promoting the widespread adoption of broadband services. Specifically, network operators might use revenue from arrangements with edge providers to subsidize the costs of end-user access, which would increase adoption.²⁹ A BIAS provider might even adopt a business model under which end users would receive access for free. Such pricing could help increase broadband penetration, especially if BIAS providers developed a targeted offering that is particularly attractive to underserved groups.³⁰

Lee and Wu (2009, p. 67) admit that:

Of course, for a given price level, subsidizing content comes at the expense of *not* subsidizing users, and subsidizing users could also lead to greater consumer adoption of broadband. It is an open question whether, in subsidizing content, the welfare gains from the invention of the next “killer app” or the addition of new content offset the price reductions consumers might otherwise enjoy or the benefit of expanding service to new users. [Emphasis in original.]

As far as I know, the Commission has never attempted to address this issue. Indeed, the Commission espouses the view that its rules will reduce the digital divide rather than maintain it.³¹ Perhaps the Commission shares Lee and Wu's view that edge providers are more deserving than the rest of us. According to Lee and Wu, “a more accurate description of a ban on payments from content providers to Internet intermediaries is this: it is a subsidy to the creative and entrepreneurial at the expense of the passive and consumptive.”³²

²⁸ As I discuss in Section IV below, when end users pay usage-sensitive access charges and are aware of the usage associated with different applications, the value of the “subsidy” may be largely eliminated because its costs will be internalized by end users as the result of BIAS providers' pricing.

²⁹ This benefit of two-sided pricing does not rely on altruism by the network provider. The ability to collect fees from application providers would lower the marginal cost of serving consumers—possibly to the point where effective marginal costs would be negative. The forces at work are similar to those that lead Google to offer consumers search services without charge.

³⁰ Although intended to serve such a role, Facebook's Free Basics service has proven to be highly controversial with proponents of net neutrality; see, e.g., McLain et al. (2016).

³¹ See, e.g., Federal Communications Commission (2015, Appendix B, ¶ 2).

³² Lee and Wu (2009, p. 67).

2.4 Addressing the Terminating Access Problem

An end user's choice of BIAS provider potentially affects the welfare of the edge providers that are trying to reach that end user: Once the end user has made his or her choice of BIAS provider, an edge provider has only one source of access to that end user. In this sense, the chosen BIAS provider is said to have a *terminating access monopoly*.³³ The Commission also refers to BIAS providers as being able to act as “gatekeepers” that are insulated from competition.³⁴ If the edge provider has no mechanisms through which to reward or punish the end user for his or her choice, then there may be an agency problem that results in the end user's making a choice of BIAS provider that is inefficient from the joint perspective of the end user and all of the edge providers that serve him or her.

Particular concern has been expressed for situations in which a BIAS provider is allowed to charge edge providers terminating access fees in order to reach its end users. Figure 2 illustrates this situation. t_K and s_K in the figure denote the access fees that are charged to the edge provider and end user, respectively, by BIAS provider $K = A, B$. Once the end user has chosen BIAS provider K , the edge provider's only one means of reaching the end user is to pay t_K . If the price, quality, and terms of edge providers' services all are independent of the end user's choice of BIAS provider, then the end user will tend to choose the BIAS provider that is most attractive from the end user's narrow perspective.

Suppose, for example, that the edge provider charges no fees to its end-user customers (e.g., its business model is based on advertising revenues) and has the same quality regardless of the BIAS provider that is used. If the two BIAS providers are otherwise identical, then the end user will choose whichever one sets s_K lower. The end user will make his or her choice without regard for the levels of t_A and t_B . Knowing that the end user is the party that chooses the BIAS provider and that the edge provider has no substitute for the chosen BIAS provider's services, the BIAS providers may compete by charging inefficiently low prices to the end user and inefficiently high prices to the edge provider.³⁵

Given this possible distortion, the terminating access problem might serve as a theoretical justification for some forms of price regulation. The Commission's ban on charging edge providers for terminating access, however, has at least three problems: First, this policy sets access charges at zero, but it is well established in the two-sided pricing literature that charging non-zero prices to users on both sides of a platform typically is efficient.³⁶ Hence, even when the terminating access problem would otherwise lead to inefficiently high prices to edge providers, reducing those prices to zero may be inefficient.

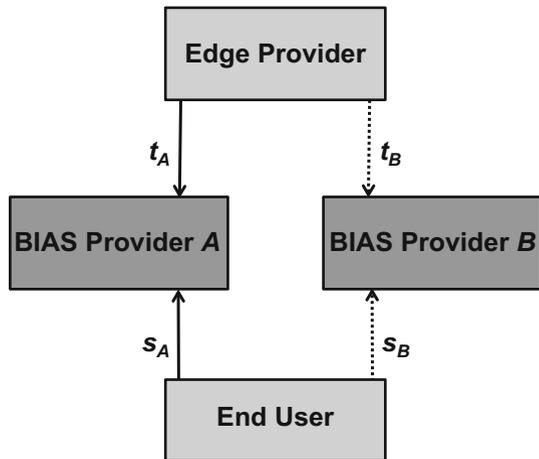
Second, and closely related, there is a “waterbed effect:” Forcing BIAS providers to charge lower prices to edge providers creates incentives for BIAS providers to charge higher prices to end users. This effect arises because end users

³³ See, e.g., Nuechterlein and Yoo (2015).

³⁴ See, e.g., Federal Communications Commission (2015, ¶ 80).

³⁵ See, e.g., Mark Armstrong (2006, pp. 669–670).

³⁶ See, generally, Rochet and Tirole (2003, 2006).

Fig. 2 The terminating access problem

are less valuable to a BIAS provider if they cannot be used as a means of deriving revenue from edge providers.³⁷ There might even be a waterbed effect in which a reduction of terminating access fees leads to an increase in the interconnection fees that are directly or indirectly paid by edge providers. The effect would arise because the prohibition of charging edge providers described in the Introduction above does not apply to arrangements for network interconnection, including existing paid peering arrangements.³⁸ The Commission does not appear to have taken these tradeoffs into account.

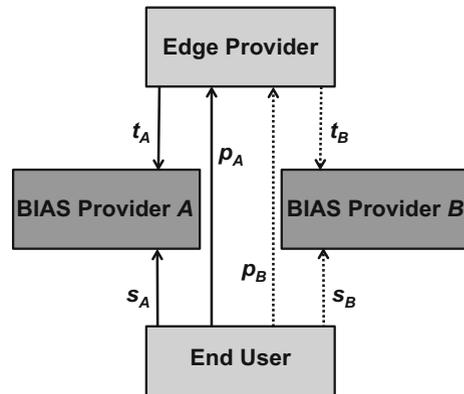
A third problem with the Commission's blanket ban is that many important applications have a mechanism for eliminating the terminating access problem. Several of the largest edge providers of video and music streaming services, as well as most e-commerce sites that sell physical products, charge end users fees for their services. When those fees can vary with the end user's choice of BIAS provider, edge providers have a means of overcoming the terminating access problem.

Figure 3 illustrates this phenomenon: p_K denotes the price that the edge provider charges the end user for the edge provider's service *conditional* on the end users' having chosen BIAS provider K . By setting $p_A - p_B = t_A - t_B$, the edge provider can induce the end user to internalize the effects of his or her choice of BIAS provider on the edge provider's profits. Of course, not all edge providers charge their customers. Consequently, the overall problem is attenuated but not completely eliminated.

³⁷ Genakos and Valletti (2011) provide further discussion of the theory of waterbed effects and present empirical evidence of its importance in mobile telephony.

³⁸ Federal Communications Commission (2015, ¶ 30). Loosely stated, a paid peering arrangement entails the payment of a fee from one high-level network to another in order to interconnect and allow the exchange of traffic that originates from the respective sets of edge providers and end users that are connected to the high-level networks.

Fig. 3 Edge provider pricing can eliminate the terminating access problem



2.5 Preventing Exclusionary Behavior

The possibility that, absent regulation, a firm that is vertically integrated into the provision of both BIAS and edge services might discriminate against competing edge providers is perhaps the most coherent concern expressed by proponents of net neutrality regulation.³⁹ Under certain conditions an integrated supplier with significant market power will find it profitable to use that market power to block or weaken rival edge providers and, thus, harm competition and consumers.

That said, the Commission has failed to establish that the threat of exclusion justifies its regulations. Although there are conditions under which exclusionary incentives arise, there is also a broad range of conditions under which an integrated service provider will not engage in exclusion.⁴⁰ The Commission has never cited substantial and credible evidence of a widespread problem of anticompetitive foreclosure or exclusion by BIAS providers.

Moreover, the Commission has not established that its regulations offer significant incremental benefit over existing state and federal antitrust policies of general applicability. The Commission has never offered a convincing explanation of why, if a BIAS provider's actions raise serious competitive concerns, those concerns could not be addressed using existing antitrust laws. In contrast with the Commission's regulations, there is substantial experience with the enforcement of antitrust laws, which is important because antitrust enforcement does not typically create the industry-wide uncertainty that has been triggered by the Commission's vague, new regulations.⁴¹

³⁹ The rules against blocking, throttling, and paid prioritization, as well as the no-unreasonable-interference/disadvantage standard are all intended, in part, to prevent such exclusionary behavior. See, e.g., Federal Communications Commission (2015, ¶¶ 17, 20, 86, 96, and 123).

⁴⁰ See, e.g., Farrell and Weiser (2003).

⁴¹ Indeed, after adopting its rules, the Commission commenced investigations of several industry practices for which the Commission had not offered an opinion as to whether the practices violate the Commission's rules. Examples included T-Mobile's Binge On service, which is discussed below, and AT&T's Sponsored Data and Data Perks programs, which exempt end users from traffic-sensitive charges for data that has been sponsored by a third party (Sherman 2015). One of Ajit Pai's first acts upon

It is also critical to recognize that, in some instances, a vertically integrated supplier may favor its own applications in ways that promote consumer welfare. For instance, favoritism may reflect efficiency benefits that arise from the coordination that is facilitated by integration and that results in greater consumer welfare (e.g., eliminating double marginalization).⁴² The Commission's net neutrality regulations—in particular, the No-Unreasonable Interference/Disadvantage Standard—increase the risks that are faced by access providers that enter into such arrangements and, thus, may attenuate their use and reduce the realization of associated benefits.

Another unintended consequence of the Commission's regulations is that they may *increase* a vertically integrated BIAS provider's incentives to engage in exclusionary behavior. "Non-BIAS data services," which are services that share facilities with BIAS but are not themselves BIAS, are exempted from the Commission's net neutrality regulations.⁴³ This exemption can increase incentives to engage in exclusion.

To see how this exclusion could occur, consider a vertically integrated BIAS provider that offers an application (e.g., cable television services) that qualifies as a non-BIAS data service and potentially competes with some applications that are provided by independent edge providers. Because of the exemption, the net neutrality regulations do not directly affect the profits that the integrated provider enjoys from offering its application.

However, the net neutrality regulations can reduce the BIAS provider's profits that are derived from providing access for the third-party application in at least two ways: First, by blocking customized access arrangements, the prohibition on paid prioritization may reduce the joint profits that the BIAS provider and third-party edge provider can derive from the latter's application. Second, the limitations on charging the third-party edge provider for access may reduce the share of joint profits that the BIAS provider can appropriate.

Both of these effects make the support of the third-party application less profitable for the BIAS provider relative to the support of its integrated application. When the integrated and third-party applications are substitutes, this shift in relative profitability can create incentives for the BIAS provider to attempt to disadvantage

Footnote 41 continued

becoming Commission Chairman was to terminate the Commission's investigations into these practices (Federal Communications Commission 2017).

⁴² In their empirical review, LaFontaine and Slade (2007, p. 680) concluded "that, under most circumstances, profit-maximizing vertical-integration and merger decisions are efficient, not just from the firms' but also from the consumers' points of view."

⁴³ The Commission takes pains to avoid offering a bright-line definition of non-BIAS data services but it cites three broad characteristics: they "are not used to reach large parts of the Internet[,] ... are not a generic platform[,] ... and use some form of network management to isolate the capacity used by these services from that used by broadband Internet access services." (Federal Communications Commission 2015, ¶ 209). This is another example of regulatory ambiguity that creates uncertainty for industry participants.

the third-party application in order to steer end users to what is—from the BIAS provider’s perspective—the more profitable application.

The issue can also be framed in terms of investment incentives. Suppose, as is plausible, that the applications that benefit the most from high-speed access services are those that most closely compete with a BIAS provider’s own applications (e.g., over-the-top video services that potentially compete with cable television services).⁴⁴ With paid prioritization, the BIAS provider has incentives to charge higher prices for priority access as a means of internalizing the resulting cannibalization of its own applications. All else equal, edge providers would rather not pay these fees, but the fees create incentives for the BIAS provider to invest in the ability to offer higher-speed services.

By contrast, if it is limited to offering best efforts to all edge providers, then in theory the BIAS provider can have incentives to reduce investment in capacity to degrade best efforts and make it difficult for those services that require high-speed access to compete with the access provider’s integrated applications.⁴⁵

3 Leveling the Playing Field as a Rationale for Banning Paid Prioritization

Perhaps the most controversial—and, I believe, misguided—of the Commission’s current net neutrality regulations is the prohibition of paid prioritization in the name of “leveling the playing field.”

It is widely recognized by economists that competition generally drives firms to act to the benefit of consumers and can play an important role both in promoting innovation and in ensuring that the benefits of that innovation accrue to consumers. It follows that policies that protect competition promote consumer welfare. However, in practice, it can be difficult to determine precisely what it means for public policy to “protect competition.”

It is often asserted that public policy should protect competition by ensuring that regulated suppliers compete on a “level playing field.” But what does it mean for a playing field to be level? One conception is that regulation does not favor one market participant over another. That is, the regulator takes the pre-intervention tilt of the field to be given and seeks to avoid imposing policies that would affect the existing tilt of the playing field in any direction. Recommendations that regulatory policy be “technologically neutral” have this flavor.

Many proponents of net neutrality regulation (including the majority of the Commission in 2015) use the term “level playing field” in a different way: These proponents actively seek to use regulation to change the tilt of the playing field

⁴⁴ The Commission defines over-the-top video services as “linear video services that travel over the public Internet and that cable operators do not treat as managed video services on any cable system” (Federal Communications Commission 2014b, footnote 199).

⁴⁵ Choi and Kim (2010) present a model in which a ban on paid prioritization can increase a BIAS provider’s incentives to invest in capacity. The economic mechanism is the following: When allowed to offer paid prioritization, the BIAS provider limits capacity in order to degrade the quality of its best-efforts service and, thus, create increased demand for its higher-priced, high-priority service.

through policies that intentionally affect competition. In their view, the field would be inappropriately tilted absent regulation and needs to be righted. Public Knowledge (n.d.) offers a more detailed expression of this view than most:

In the absence of net neutrality, companies can buy priority access to ISP customers. Larger, wealthier companies like Google or Facebook can pay ISPs to provide faster, more reliable access to their websites than to potential competitors. This could deter innovative start-up services that are unable to purchase priority access from the ISPs.

Essentially, the argument is that competition must be limited to protect competition.⁴⁶

In the next part of this section, I address the myth that the Commission's rules serve to return the Internet to the state of grace that existed before Internet access providers were tempted by the apple of non-neutrality. I then turn to the economics of paid prioritization and the type of leveling that the Commission's rules impose.

3.1 The Internet is not now—and has never been—neutral

The Commission has propounded the myth that the Internet has prospered by working equally well for all applications. For example, according to a document that preceded the Commission's February 2015 decision to impose the current regulations, “[b]ecause the Internet's creators did not know—and did not want to pre-determine—what would emerge and succeed on the network, they chose an architecture that did not favor particular applications.”⁴⁷

In fact, the Internet's creators designed an architecture that is better suited for some applications than others. The Internet works relatively poorly for applications that are highly sensitive to packet loss and require very low latency (e.g., telepresence) and works relatively well for applications that require little bandwidth and are not time sensitive (e.g., email). Moreover, Internet engineers have long recognized the value in differentially treating applications because of differences in the requirements that they place on a network.⁴⁸ David Clark, a distinguished computer scientist who served as chief protocol architect of the Internet until its commercialization, colorfully summarized the situation in an interview⁴⁹:

“The network is not neutral and never has been,” Clark said, dismissing as “happy little bunny rabbit dreams” the assumptions of net neutrality

⁴⁶ Paid prioritization is not unique in this regard. Debates about retail slotting allowances can be similarly structured: Manufacturers pay for preferential display space, which some observers argue is a form of competition, while other observers argue that such fees are anticompetitive.

⁴⁷ Federal Communications Commission (2014a, ¶ 3).

⁴⁸ For example, the specification for IPv6, which was released by the Internet Engineering Task Force in 1998, added the functionality to “enable the labeling of packets belonging to particular traffic ‘flows’ for which the sender requests special handling, such as non-default quality of service or ‘real-time’ service” (Deering and Hinden 1998, p. 2). See also, The Internet Engineering Task Force document that defined “an architecture for implementing scalable service differentiation in the Internet” using IPv6 (Blake et al. 1998, p. 1).

⁴⁹ Piper (2009).

supporters that there was once a “Garden of Eden” for the Internet. NSFnet, an early part of the Internet backbone, gave priority to interactive traffic, he said ...

The Internet is non-neutral in other ways: Edge providers can and do buy premium access today. Content delivery networks (CDNs), such as Akamai and BitGravity, sell services that improve the speed and quality at which their customers’ content can be accessed by end users.⁵⁰ Similarly, large edge providers (e.g., Apple, Facebook, and Google) operate private networks that connect to the Internet but provide the edge providers higher quality transport of their packets than would be available by relying purely on the public Internet.⁵¹ Lastly, the exchange of traffic among networks is not all equal, and networks can have interconnection facilities of varying quality.

3.2 Lack of a Limiting Principle

The level-playing field argument suffers from a critical lack of a limiting principle. For example, electricity is a critical input for almost all businesses. Applying the logic of the ban on paid prioritization, one would require all firms to purchase the same amount of electricity to ensure that larger firms do not gain competitive advantage over innovative start ups by making greater use of electricity. The logic of net neutrality would also argue for banning e-commerce sites from purchasing faster delivery from FedEx or UPS, or from offering free shipping.

Moreover, as was just discussed above, edge providers already have many ways to purchase superior access today. Arguments that paid prioritization tilts the playing field among third-party edge providers apply equally to arrangements such as private networks or CDNs that do not involve a BIAS provider. It is sometimes argued that BIAS provider market power and/or the use of paid prioritization to engage in price discrimination are reasons to single out BIAS for special treatment. But, as I discuss below, such arguments do not justify banning paid prioritization.⁵²

3.3 Some Economics of Leveling the Playing Field

A fundamental potential pitfall with the leveling-the-playing-field rationale is that it risks focusing on competitor welfare (i.e., those firms that for some reason would be unable to benefit from paid prioritization) rather than consumer welfare or efficiency. A ban on paid prioritization is similar to a cartel agreement that bans competition along certain dimensions. Although a cartel might stop some suppliers from gaining competitive advantage over others and might promote entry (e.g., by weakening competition from incumbent providers), those possibilities generally are not considered to be valid defenses of cartels. Restricting the ability of firms to offer

⁵⁰ CDNs do so by using a network of distributed servers to cache material at locations that are nearer to end users.

⁵¹ Fitzgerald and Wakabayashi (2014).

⁵² For example, as is discussed below, intermediate-good price discrimination can tend to tilt the playing field in favor of smaller, high-cost suppliers.

different quality levels can harm end users and efficiency by leading to lower quality, distorted product choices, and less variety. It is thus important to focus on the competitive process and consumer—rather than competitor—welfare.

As a general matter, the welfare economics of leveling the playing field can be complex and depend on: (a) why the playing field would be uneven absent intervention; and (b) the nature of the leveling process. Consider the first factor: Public Knowledge is not alone in asserting that the option to purchase paid prioritization would benefit larger, wealthier edge providers. But it is not evident that such a pattern should hold. When edge providers all face access charges that vary with traffic volume, each provider should calculate whether obtaining a higher priority allows it to obtain incremental revenues (from either advertisers or end users) that are greater than the incremental costs of the higher priority.⁵³ No general principle states that an entrant or smaller incumbent should be at a disadvantage relative to a large incumbent in this regard. Indeed, if faster speeds generally disfavored entrants, then perhaps the Commission would want to consider abandoning its persistent calls for BIAS providers to offer higher access speeds.

Now consider the second factor: A standard homogeneous good oligopoly “Cournot” model (which involves sellers that use quantities as their choice variable) provides insight into why the welfare effects depend on the nature of the leveling process and can be difficult to calculate. Suppose that there are multiple active suppliers and that each supplier’s marginal costs are constant but not necessarily equal to those of its rivals. In this simple model, total surplus depends on both the total output and how production of that total is allocated across different producers. Leveling the playing field by raising the marginal costs of low-cost firms generally reduces output and shifts production to higher-cost suppliers. Therefore, such policies reduce total surplus.

By contrast, the effects of policies that level the playing field by reducing the costs of high-cost firms are ambiguous. This ambiguity arises when the higher-cost firms remain less-efficient producers even after the policy is implemented: The cost reduction raises total surplus by raising total output (which typically is below the efficient level due to the exercise of oligopolistic market power) but also reduces total surplus by reallocating production toward less efficient firms. Either effect may dominate.⁵⁴

Is a ban on paid prioritization better modeled as a decrease in high-cost edge providers’ costs or as an increase in low-cost edge providers’ costs? The answer depends in part on what speeds BIAS providers offer with and without the ban. First, suppose the quality of non-priority access is the same with or without the ban; the ban’s only effect is to eliminate an option. Then, to the extent that one subscribes to the view that, absent regulation, paid prioritization will tend to be purchased by more successful suppliers, the effects of a ban on paid prioritization

⁵³ To the extent that the costs of paid prioritization are fixed costs or are generally subject to economies of scale, there would appear to be a better case to be made that paid prioritization can harm entrants and small incumbents. I return to this point below.

⁵⁴ Katz and Shapiro (1985, pp. 510–511) make this point and provide explicit calculations in the context of patent licensing.

will be similar to raising low-cost supplier's costs. In this case, welfare will very likely fall.

At the other extreme, suppose a ban on paid prioritization—coupled with a ban on charging for baseline terminating access—induces BIAS providers to provide service quality that is equal to that of what would have been the priority service. In this case, the effects on welfare are ambiguous. Of course, other configurations of access speeds are possible, which further adds to the ambiguity.

In the light of the considerable difficulties in conducting a full-blown welfare analysis, suppose one focused on how regulation affects entry incentives, which might arguably be viewed as a proxy for innovation effects that can be expected to be the most important determinant of long-run welfare effects. Consider the following five-stage game as a conceptual framework for exploring the effects of paid prioritization on entry:

- In stage one, a monopoly BIAS provider chooses whether to offer either one or two terminating-access quality levels (possibly subject to regulatory restraints) from the set {low, high} and sets the prices for those terminating access services. The latter take the form of lump-sum charges.⁵⁵
- In stage two, an incumbent edge provider chooses the quality of service to purchase from the BIAS monopolist.
- In stage three, a potential entrant edge provider chooses whether to enter the market and, if it does, what quality of terminating access service to purchase from the BIAS monopolist.
- In stage four, the edge providers simultaneously choose the prices they charge end users.
- Finally, in stage five, end users make their purchase decisions, and profits and consumer surplus are realized.

Here, I focus on subgame perfect equilibria in stages two through five.

A first point to observe in this framework is that it is well-established in the economics literature that paid prioritization can *facilitate* entry. Specifically, there are conditions under which the choice of a different termination quality than that of the incumbent allows the entrant to differentiate its product and, thus, relax price competition that would otherwise be so intense that the entrant could not cover its fixed costs.

Suppose, for example, that different choices of access speeds are the only possible source of differentiation between the two edge providers (i.e., end users consider the edge providers' services to be otherwise identical) and that the two firms have the same, constant marginal cost of production. Then, as is well known, undifferentiated "Bertrand" competition will drive equilibrium prices to marginal cost. Because the BIAS provider charges a fixed fee for its services, it follows that, if the two edge providers choose the same quality level as one another, then both will suffer losses. However, if the edge providers choose different access quality levels and end users have heterogeneous preferences for increased speed, then the

⁵⁵ This assumption that the BIAS provider charges lump sums for terminating access maximizes the chance that paid priority can be used by the incumbent edge provider to deter entry.

Table 1 Paid priority can facilitate entry

Entrant's quality	Incumbent's quality	
	Low	High
Low	-, -	+, +
High	+, +	-, -

The first entry in each box shows the sign of the entrant's payoff, while the second shows the sign of the incumbent's payoff

resulting vertical differentiation leads to equilibrium prices above marginal costs and there exist parameter values for which entry is profitable.⁵⁶

Table 1 illustrates the resulting signs of edge providers' payoffs as a function of their actions. The first entry in each box shows the sign of the entrant's payoff, while the second shows the sign of the incumbent's payoff. I assume throughout that the incumbent's profits are positive if the follower chooses not to enter.

To examine the effects of regulation, first assume that paid prioritization is allowed, so that the BIAS provider offers both options. As is clear from inspection of Table 1, in equilibrium, the incumbent will choose either high or low (at this level of generality the one chosen is indeterminate), and the follower will enter and choose whichever priority the incumbent does *not* choose. Absent regulation, entry occurs.

Next, suppose that a ban on paid prioritization forces the BIAS provider to offer only a single access quality. The incumbent will choose that quality and the potential entrant will choose to stay out of the market rather than suffer losses.⁵⁷ In other words, banning paid priority eliminates entry and has exactly the opposite of the effect that is claimed by its proponents.⁵⁸

Of course, under some parameter values, the incumbent edge provider can deter entry by purchasing higher-quality termination while entry would be profitable if the incumbent were forced to purchase the lower-quality termination. In this way, high quality could serve as a form of entry deterrence along the lines of capacity in the Dixit (1980) and Spence (1977) model of entry deterrence. Table 2 illustrates one such situation.⁵⁹ Given the choice of priority, the incumbent edge provider will choose high, and entry will be unprofitable.⁶⁰

⁵⁶ See, for example, Tirole (1988, §7.5.1, particularly p. 297) and Motta (1993, § II(i)).

⁵⁷ Allowing end users to choose to purchase different qualities of Internet access would not change this result because the edge providers would still be undifferentiated from one another.

⁵⁸ In the model considered in the text, the incumbent and entrant may be equally affected by network congestion. But in general there can be asymmetries such that the entrant derives relatively greater value from higher priority. Choi et al. (2015) examine a model in which paid priority can facilitate entry by edge providers that have applications that are highly sensitive to congestion.

⁵⁹ This pattern of payoffs can be generated by considering a Hotelling model in which the edge providers are horizontally differentiated and all consumers equally value increased priority. Part 1 of the "Appendix" sketches such a model. An increase in priority has the same effect as a downward shift in marginal cost in the Dixit-Spence capacity model.

⁶⁰ One might argue that an edge provider's choice of access priority is readily changed and, thus, would not serve as a commitment device that is capable of deterring entry. Such an argument would further weaken the claim that a ban on paid prioritization promotes entry.

Table 2 Purchasing high-priority access may deter entry

Entrant's quality	Incumbent's quality	
	Low	High
Low	+,+	-,+
High	+,-	-,-

The first entry in each box shows the sign of the entrant's payoff, while the second shows the sign of the incumbent's payoff

Whatever one thinks of an incumbent's use of high-quality BIAS to preempt entry, banning the provision of low-quality BIAS alone will not solve the problem. If the BIAS provider finds it profitable to set prices that drive out the low end of the market when it can offer low-end services, then it will also find it profitable to drive out the low end of the market when it is forced to set infinite prices for low-end services (e.g., under regulation, the BIAS provider might offer only the high-quality option in Table 2). Thus, to be effective, a ban on paid priority has to be coupled with a ban on terminating access charges overall—the latter of which raises the issues that were examined in Section II above.

This discussion of paid prioritization does not provide definitive conclusions with regard to its welfare effects. But it does establish that there is not a sound theoretical argument for the assertion that paid prioritization generally harms welfare or suppresses entry. Rather, the effects of paid prioritization are fact specific. The need for a fact-specific analysis is further highlighted by the U.S. Department of Justice's position that "most favored nation" (MFN) clauses—which prevent one buyer from obtaining more favorable terms than another—can harm competition because they prevent entrants from gaining competitive advantage over incumbents by reaching more favorable agreements with input suppliers.⁶¹ This conclusion regarding MFNs is relevant because a ban on paid prioritization can be viewed as a form of MFN clause.

In many respects, the situation with respect to paid prioritization is similar to that of price discrimination, which can in some circumstances enhance economic efficiency and benefit consumers, and in other circumstances have the opposite effects. Indeed, under some conditions, paid prioritization can be used to engage in price discrimination.⁶² Of course, given the ambiguous welfare effects of price discrimination, it does not follow that banning paid prioritization increases either

⁶¹ See, e.g., U.S. Department of Justice (1997). See also, Scott Morton (2012, p. 13). Public Knowledge (2015, § III.B.8) has also argued in a different context that, under certain conditions, MFNs can make it more difficult for small buyers to compete.

⁶² It should be noted that paid priority need not constitute price discrimination. For instance, paid priority can be a form of peak load pricing. The Commission has stated that "[w]hen bandwidth is limited during peak hours, its scarcity can cause reliability and quality concerns, which increases broadband providers' ability to charge for prioritization" (Federal Communications Commission 2015, ¶ 82). Charging higher prices during peak periods may simply be the efficient pricing of a scarce resource. In fact, failing to charge higher prices for peak use is a form of discrimination against off-peak users. A promising area of analysis is to consider micro peaks that last a fraction of a second.

total or consumer surplus.⁶³ Nevertheless, the Commission cites three publications of mine regarding price discrimination⁶⁴ and claims that they support the conclusion “that paid prioritization network practices actions harm consumers, competition, and an innovation, as well as create disincentives to promote broadband deployment.”⁶⁵ They do not.

In Katz (1987, Proposition A.4), I showed that, when a discriminating upstream monopolist sells to downstream Cournot competitors and the seller is perfectly informed about the cost and demand conditions that the buyers face, the monopolist charges higher prices to those firms whose production costs (excluding the cost of the monopolized input) are lower. DeGraba (1990) demonstrated that this pattern of input pricing dampens the downstream firms’ incentives to make cost-reducing investments.

Thus, discrimination can harm edge provider investment, but the model indicates that it happens in a way that is the *opposite* of the way that the Commission hypothesizes: The discrimination would tend to be against successful incumbents rather than against struggling new entrants. Moreover, the Commission ignored subsequent research, such as Inderst and Valletti’s (2009) analysis of third-degree price discrimination in input markets⁶⁶: Those authors find that a ban on discrimination “stifles incentives to invest and innovate.”⁶⁷

In addition to misinterpreting and/or ignoring various analyses of third-degree price discrimination, the Commission failed to recognize the critical differences between second- and third-degree price discrimination. Second-degree discrimination is highly relevant—paid prioritization may be used as a screening device (i.e., as second-degree price discrimination)—but is not mentioned by Federal Communications Commission (2015). Paid prioritization can serve as a screening device only if either edge providers or end users have heterogeneous tastes, which creates the possibility that variety is valuable and that it is efficient to offer a range of differentiated services. In a theoretical analysis of two-sided pricing, Benjamin Hermalin and I examined the effects of preventing a BIAS provider from offering edge providers a menu of prices for different grades of terminating access services. Our central findings were⁶⁸

that the net welfare effects can be positive or negative, although the analysis suggests to us that harm is the more likely outcome. Moreover, applications at

⁶³ Even the Commission has admitted that there are forms of discrimination that promote consumer welfare. See, e.g., Federal Communications Commission (2009, ¶103).

⁶⁴ Federal Communications Commission (2015, footnote 296), citing Katz (1983, 1984, 1987).

⁶⁵ Federal Communications Commission (2015, ¶ 125).

⁶⁶ Broadband access can be viewed as an input into the production of online application services or as an input into the goods and services that are produced by business end users of broadband Internet access services.

⁶⁷ Inderst and Valletti (2009, p. 1). See also, O’Brien (2014), who extends Katz (1987) to consider bargaining and finds that forbidding price discrimination in the provision of an intermediate good is often socially harmful.

⁶⁸ Hermalin and Katz (2007, p. 236). Weyl (2010, p. 1667) offers another theoretical model that sheds light on the difficulties of regulating two-sided prices and provides what Weyl concludes is “a further rationale for allowing price discrimination in two-sided markets.”

the bottom of the market—the ones that a single-product restriction is typically intended to aid—are almost always harmed by the restriction, and consumers have fewer applications available to them as a consequence.

4 Neutralizing Net Neutrality

In this section, I consider the possible interaction of market developments and the Commission's current net neutrality regulations, and I conclude that these developments could largely neutralize the regulations unless they are expanded to constrain BIAS providers' actions further.

The first development is the increased implementation of usage-sensitive pricing, largely as a response to network congestion.⁶⁹ Network congestion will very likely continue to be an issue as the applications offered by edge providers continue to evolve and end users have ever-increasing demand for bandwidth. Congestion will be particularly relevant for mobile broadband networks, which generally have less capacity than fixed networks and are increasingly relied upon by end users for Internet access.

The Commission's net neutrality regulations may create increased incentives to implement usage-sensitive pricing as a response to congestion.⁷⁰ The regulations may do so because one of the roles of traffic management is to reduce congestion by limiting certain traffic streams. Because the Commission's rules make traffic management more difficult and costly for BIAS providers to implement, the rules create incentives for BIAS providers to turn to substitute actions. If consumers are sufficiently well-informed about the traffic flows that are associated with various applications, usage-based pricing can be such a substitute. Under these conditions, when BIAS providers implement usage-sensitive pricing, consumers will be less willing to pay for and use traffic-intensive applications, all else equal.

The second likely development will be the continued growth in the relative importance of edge providers that collect fees from end users. Although most academic models of net neutrality assume there are no such payments, many of the most important applications involve the exchange of payments between end users and edge providers.⁷¹ Examples include audio and video streaming services, as well as a wide range of e-commerce services, including those associated with the so-called sharing economy. The continued deployment of online and mobile payment systems should promote the growth in fee collection by edge providers, and the rise of ad blockers may undermine advertising-based business models and push edge providers to make greater use of charges to end users.

The combination of usage-sensitive pricing and payments between end users and edge providers has powerful implications for the effects of the current set of net

⁶⁹ Even if BIAS networks do not suffer from congestion, usage-based pricing can be a profitable strategy for engaging in price discrimination, and it can be an efficient means of recovering fixed costs (i.e., it can implement Ramsey pricing).

⁷⁰ Although this is an unintended consequence, it may not be a negative one.

⁷¹ Gans (2015) is an exception, although some of its central results are incorrect. Gans and Katz (2016) provide corrected versions of the results and establish conditions on which net neutrality has no effects.

neutrality regulations. Specifically, these developments interact with a gap in the current regulations. In its 2015 order, the Commission stated that⁷²:

Because our no-throttling rule addresses instances in which a broadband provider targets particular content, applications, services, or non-harmful devices, it does not address a practice of slowing down an end user's connection to the Internet *based on a choice made by the end user*. [Emphasis added.]

This treatment of end-user choices is consistent with the Commission's purported support of consumer sovereignty and choice. For example, in 2010 the Commission stated that "[m]aximizing end-user control is a policy goal Congress recognized in section 230(b) of the Communications Act, and end-user choice and control are touchstones in evaluating the reasonableness of discrimination."⁷³

Although a majority of the Commission voiced support for the current net neutrality regulations and for consumer choice, there is a fundamental tension between the two when edge providers charge end users for their services: If BIAS providers can offer a menu of usage-sensitive pricing options that allow end users to choose the quality of their connections on an edge-provider-specific basis, then banning paid priority—or even prohibiting BIAS providers from levying *any* charges on edge providers—has no effect on the equilibrium outcome. In other words, consumer choice neutralizes the net neutrality regulations.

Figure 4 illustrates the underlying forces that are at work⁷⁴: The figure shows a single BIAS provider and two edge providers that serve a single end user. Initially, the BIAS provider is assumed to be able to charge edge providers for access to the end user and to offer paid prioritization. $T(q_i)$ denotes the fee that is paid by edge provider i for terminating access of quality q_i . $S(q_i)$ denotes the fee that is paid by the end user to connect to edge provider i with an access service of quality q_i . Lastly, $P_i(q_i)$ denotes the fee that edge provider i charges the end user for the service that is delivered with access quality q_i . Label the equilibrium price schedules that arise in the absence of regulation as $T^e(\cdot)$, $S^e(\cdot)$, and $P_i^e(\cdot)$.

Now suppose that regulation blocks the BIAS provider from charging any fees to edge providers for access. There is an alternative set of prices— $T^n(\cdot) \equiv 0$, $S^n(\cdot) = S^e(\cdot) + T^e(\cdot)$, and $P^n(\cdot) = P_i^e(\cdot) - T^e(\cdot)$ —that satisfy the net-neutrality regulation but that yield exactly the same payoffs to all agents for any given access service quality q_i . Intuitively, the BIAS provider collects terminating access fees from the end user, and the edge providers then reimburse the end user by reducing their service fees.

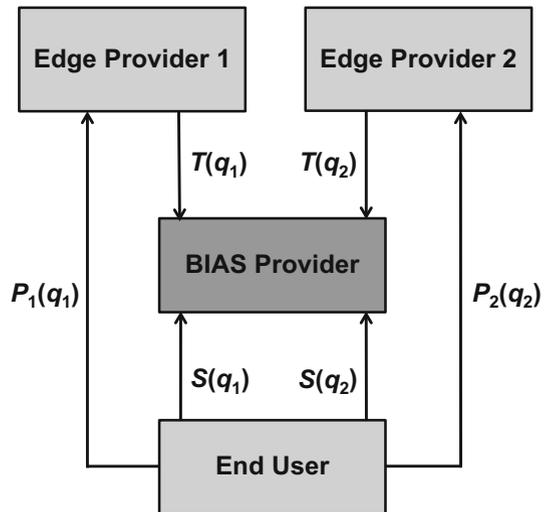
In addition to demonstrating the fundamental tension between net neutrality regulation and consumer choice, this simple example illustrates why attempts to block sponsored data may be destined to fail. Sponsored data refers to the practice

⁷² Federal Communications Commission (2015, ¶ 122). However, the Commission also appears to express skepticism with respect to "a distinction between paid prioritization that is not directed by end users, and prioritization arrangements that are user-driven." *Id.*, footnote 22, quoting a filing by AT&T.

⁷³ Federal Communications Commission (2010, ¶ 71), footnote omitted.

⁷⁴ I provide an algebraic analysis in Part 2 of the "Appendix".

Fig. 4 The neutrality of net neutrality



of having an edge provider pay an end user's usage-based access charges, similar to a toll-free number for traditional telephone service. Some people consider sponsored data to violate net neutrality because it allows an edge provider to pay the BIAS provider so that the edge provider's end-user customers receive access on more favorable terms. However, it may be impossible to prevent edge providers from implicitly sponsoring data even if the Commission chooses to block them from explicitly doing so.

In particular, an edge provider that itself levies usage-sensitive charges on end users could reduce those charges to compensate end users for the fees that they pay to their BIAS providers. This possibility again illustrates the quixotic nature of attempts to isolate edge providers from the costs of access services and to deny them the ability to compete in terms of end users' Internet access experiences.

5 Conclusion

Do these neutrality results mean that all of the fuss over net neutrality regulation has been—and continues to be—a colossal waste of time? Not entirely. Not all edge providers charge their customers fees, and even those that do charge end users might not charge BIAS-provider-specific prices. But these results—as well as much of the discussion in earlier parts of this article—highlight how much the effects of the regulations depend on market institutions in ways that are completely unaddressed by the Commission.

These findings also suggest that the current net neutrality regulations are highly unstable—even holding aside the uncertainty created by the recent change of administration. The instability arises because the rules are unlikely to have their intended effects. If the Commission and Congress choose to retain at least some of

the Commission's existing rules, there will be pressures to expand the scope of net neutrality regulations and further limit BIAS providers' conduct.⁷⁵ Areas where net neutrality proponents will very likely seek expanded regulation include the following:

- *A ban on usage-sensitive pricing for BIAS sold to end users* Because usage-sensitive pricing places economic pressures on edge providers whose services consume large amounts of bandwidth and creates an indirect pathway for edge providers to purchase access for their customers, net neutrality proponents may push to ban such pricing.
- *A ban on allowing consumers to choose BIAS bandwidth on an application-specific basis* If BIAS providers offer end users the ability to make and pay for real-time or application-specific speed choices, then end users will almost certainly choose to reach some applications through fast lanes, and there will be economic pressures for edge providers to compensate consumers for the costs of those fast lanes. A likely response to these facts is that proponents of net neutrality will push to eliminate choice in the name of promoting choice. Indeed, T-Mobile's "Binge On" service and Facebook's "Free Basics" initiative might be examples where this already has happened.⁷⁶ Under Binge On, a consumer can choose to connect to one class of edge provider services at slower speeds in return for having the traffic that is associated with those services not count in the calculation of the end user's purchase of BIAS services. Free Basics offers end users in developing countries free access to a set of websites via mobile wireless networks.⁷⁷ Both Binge On and Free Basics have been attacked as violations of net neutrality, despite (or because of) the fact that they provide consumers with additional options.⁷⁸
- *Price and quality regulation of interconnection* As noted above, the Commission's net neutrality rules do not apply to arrangements for network interconnection, including paid peering arrangements.⁷⁹ However, prior to the recent change in administration, the Commission has stated that it possesses the authority to oversee these arrangements under various provisions of the relevant statute.⁸⁰ And, in 2016, the Commission expressed its preferences with regard to

⁷⁵ In this regard, it is notable that Senate Commerce Committee Chairman John Thune, while opposed to key elements of the Commission's 2015 net neutrality decision (namely, the reclassification of ISPs as common carriers), has expressed support for retaining the prohibition of paid prioritization (Amir Nasr, "Thune Not Waiting for FCC to Act Before Drafting Net Neutrality Bill," Morning Consult, February 13, 2017, available at <https://morningconsult.com/2017/02/13/thune-not-waiting-fcc-act-drafting-net-neutrality-bill/>, site visited February 21, 2017).

⁷⁶ I write "might" in the text because, at the time that I am writing this, there is debate about how easy it is for edge providers to comply with the technical requirements for participating in Binge On and, thus, whether it excludes some edge providers.

⁷⁷ Any edge provider can seek to have its web site included, but to do so the edge provider must meet certain technical requirements, which essentially state that the application must make limited use of bandwidth and handset capabilities; see, e.g., Facebook (n.d.).

⁷⁸ See, e.g., van Schewick (2016) and McLain et al. (2016).

⁷⁹ Federal Communications Commission (2015, ¶ 30).

⁸⁰ *Id.*, ¶¶29, 195.

peering arrangements by prohibiting Charter from collecting fees for a broad class of interconnection arrangements for seven years as a condition for approving its merger with Time Warner Cable.⁸¹ Arguably, the underlying political economy reason for net neutrality regulation is to protect large, successful edge providers from rent extraction by BIAS providers. This reason provides a plausible explanation of the political pressure to ban terminating access charges even in situations where there is not a terminating access monopoly problem. This reason also suggests that there will be a push to regulate interconnection prices tightly to block that avenue of rent extraction. And to the extent the Commission does so, the regulation will create incentives to engage in non-price discrimination, which will lead to calls for the regulation of interconnection quality.

Sadly, there is no reason to believe that the political battles over net neutrality will end anytime soon.

6 Appendix

This appendix provides technical details for two points that were made in the text.

6.1 An Example of Payoffs for which Paid Priority may Deter Entry

Consider a typical Hotelling model of competition between two edge providers. The edge providers' locations are exogenously set at the opposite ends of a unit Hotelling line. End users are uniformly located along the line with unit density, and every consumer incurs a disutility of δ per unit of distance between the end user and the edge provider along the line. Because of limited attention, an end user consumes the service of at most one edge provider and consumes either zero or one unit of that service. A consumer x units away from edge provider i derives surplus equal to $\theta q_i - \delta x - p_i$ from consuming a unit of edge provider i 's service, where p_i and q_i are edge provider i 's price and access priority, respectively. θ is the positive, common value that end users place on access quality.

Depending on the regulatory regime, the BIAS provider offers one or two priority levels from the set $\{q_L, q_H\}$, where $\Delta \equiv q_H - q_L > 0$. For convenience, assume that: edge providers have no costs other than the fees paid to the BIAS provider; $\theta q_L > \delta$; and $\theta \Delta < 3\delta$. These assumptions assure that, conditional on entry, the edge providers have overlapping market areas and the relevant demand functions are⁸²:

$$D_i(p, q) = \frac{\delta + \theta(q_i - q_j) - (p_i - p_j)}{2\delta}.$$

⁸¹ Federal Communications Commission (2016, § V.C.5.a).

⁸² For expositional economy, here and below I do not report the calculations for corner solutions.

Conditional on the existing quality levels, firm i chooses its price to maximize $p_i D_i(p, q) - F(q_i)$, which yields the best-response functions $p_i^* = 1/2(\delta + \theta(q_i - q_j) + p_j)$. Conditional on the quality levels, the resulting equilibrium prices and profits are $p_i = \delta + 1/3\theta(q_i - q_j)$ and $\pi_i = \frac{(3\delta + \theta(q_i - q_j))^2}{18\delta} - T(q_i)$, respectively.

As is well known, when the two edge providers choose the same level of priority, $q_j \in \{q_L, q_H\}$, each edge provider earns

$$1/2\delta - T(q_j).$$

If one firm chooses high quality and the other chooses low quality, then the edge provider that chooses low priority earns

$$\frac{(3\delta - \theta\Delta)^2}{18\delta} - T(q_L) < 1/2\delta - T(q_L),$$

while the edge provider that chooses high priority earns

$$\frac{(3\delta + \theta\Delta)^2}{18\delta} - T(q_H) > 1/2\delta - T(q_H).$$

It is evident that parameter values can be chosen to satisfy the conditions that are stated in Table 2.

6.2 Neutering Net Neutrality

This part of the appendix presents a neutrality result in the spirit of Gans and King (2003). Some notation is necessary:

- $B_{ij}(x, q)$ is the dollar benefit that consumer i derives from consuming x units of content from edge provider j with the use of an Internet connection with characteristics q . For convenience, utility is assumed to be additively separable across edge providers.
- $A_j(x, q)$ is the revenue that edge provider j derives from other sources (e.g., advertising) net of any costs other than payments for terminating access.
- $S_k(v, q)$ is the access fee paid by an end user who consumes v units of access service of quality q from BIAS provider k . Observe that the fee is assumed to be independent of the identity of the edge provider patronized by the end user.
- $T_k(v, q)$ is the termination charge that is levied by BIAS provider k on an edge provider for v units of service of quality q . Observe that the fee is assumed to be independent of the identity of the edge provider.
- $V(x; \varphi)$ is the volume of traffic that is necessary to provide x units of content from an app with efficiency φ . The efficiency of an app is determined by technology and choices made by the edge provider that offers the app.
- $P_{jk}(x, q)$ is the price charged to an end-user customer by edge provider j when it delivers x units of content to the customer via BIAS provider k and the quality of the Internet connection is q .

The analysis proceeds by comparing two regulatory regimes: First, suppose that there is no net neutrality regulation and that two-sided pricing and paid prioritization are allowed. Let $S_k^e(v, q)$ and $T_k^e(v, q)$ denote the BIAS provider's equilibrium price schedules.⁸³ If edge provider j sets its price schedule, $P_{jk}(x, q)$, then the consumer chooses x and q to maximize

$$B_{ij}(x, q) - S_k^e(V(x; \varphi), q) - P_{jk}(x, q). \quad (1)$$

Let $q^*(P, \varphi)$ and $x^*(P, \varphi)$ represent, respectively, a connection quality and a quantity of the edge provider's service that is consumed that are a solution to maximizing expression (1). Given the end user's behavior, edge provider j chooses its price schedule and efficiency level to maximize:

$$P_{jk}(x^*(P, \varphi), q^*(P, \varphi)) + A_j(x^*(P, \varphi), q^*(P, \varphi)) - T_k^e(V(x^*(P, \varphi); \varphi), q^*(P, \varphi)). \quad (2)$$

Label a solution to this maximization problem as $P_{jk}^e(x, q)$ and φ^e .

Now, suppose that the net neutrality regulation is imposed and that it bans paid prioritization and terminating access charges. Define the net-neutral price schedules $S_k^n(v, q) = S_k^e(v, q) + T_k^e(v, q)$ and $T_k^n(v, q) \equiv 0$. Suppose the edge provider charges $P_{jk}^n(x, q) = P_{jk}(x, q) - T_k^e(V(x; \varphi), q)$. Conditional on the value of φ , the end user chooses x and q to maximize:

$$B_{ij}(x, q) - S_k^n(V(x; \varphi), q) - P_{jk}^n(x, q) = B_{ij}(x, q) - S_k^e(V(x; \varphi), q) - P_{jk}(x, q). \quad (3)$$

Expression (1) and the right-hand-side of Eq. (3) are identical. Hence, if the edge provider sets price schedule $P_{jk}^n(x, q) = P_{jk}(x, q) - T_k^e(V(x; \varphi), q)$, then $x^*(P, \varphi)$ and $q^*(P, \varphi)$ are a solution to the end-user's choice problem as before. Observe that P is a shorthand for $P_{jk}(x, q)$ in the argument of the end-user's best-response functions. If we use the fact that $T_k^n(v, q) \equiv 0$, then the edge provider's profits are:

$$\begin{aligned} & P_{jk}^n(x^*(P, \varphi), q^*(P, \varphi)) + A_j(x^*(P, \varphi), q^*(P, \varphi)) \\ &= P_{jk}(x^*(P, \varphi), q^*(P, \varphi)) + A_j(x^*(P, \varphi), q^*(P, \varphi)) \\ &\quad - T_k^e(V(x^*(P, \varphi); \varphi), q^*(P, \varphi)) \end{aligned} \quad (4)$$

A comparison of expressions (2) and (4) shows that they are identical and, hence, the solution sets for the choice of $P_{jk}(x, q)$ are the same.

In summary, this analysis demonstrates that any outcome that is an equilibrium in the absence of net neutrality regulation is also an equilibrium under regulation.

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⁸³ There is no requirement that these be unique.

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